

PCT

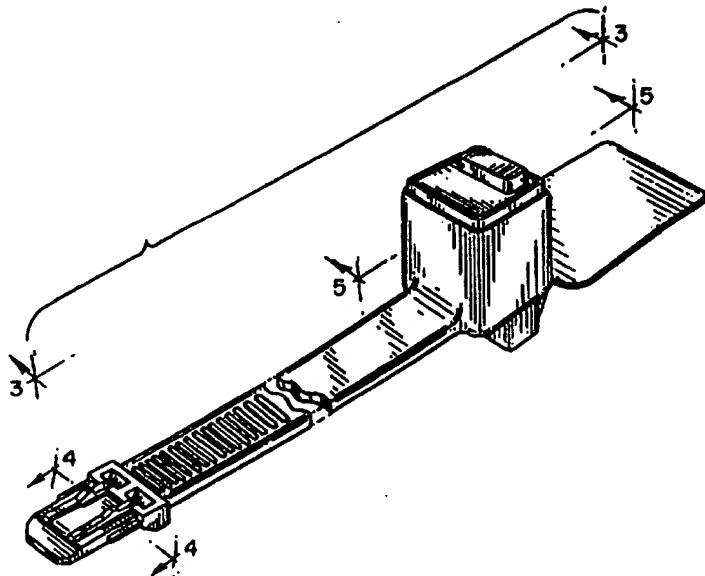
WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : B65D 33/34, 55/06		A1	(11) International Publication Number: WO 96/12654
			(43) International Publication Date: 2 May 1996 (02.05.96)
(21) International Application Number: PCT/US95/13117		(81) Designated State: GB.	
(22) International Filing Date: 20 October 1995 (20.10.95)		Published <i>With international search report.</i>	
(30) Priority Data: 08/326,600 20 October 1994 (20.10.94) US			
(71) Applicant: AMERICAN CASTING AND MANUFACTURING CORPORATION [US/US]; 51 Commercial Street, Plainview, NY 11803 (US).			
(72) Inventor: WENK, Joseph, H., C.; Charlemagne Road, Huntington Bay, NY 11743 (US).			
(74) Agent: KAMMER, A., Thomas; Hoffmann & Baron, 350 Jericho Turnpike, Jericho, NY 11753 (US).			

(54) Title: **TAMPER-PROOF CARGO SEAL**



(57) Abstract

A tamper-resistant seal (10) for securing cargo container doors, overseas shipping containers and the like is provided. The seal includes a housing (16) including a strap engagement assembly (22). An elongate strap (18) is coupled to the housing and includes a free end (24) insertable within the housing. The free end of the strap is engageable with the strap engagement assembly. A first locking device is mounted to the free end of the strap (28). The locking device includes a body portion which is suspended such that it is deflectable upon insertion within the housing and engagement with the engagement assembly. The strap further includes ratchet teeth (34) which are engageable with a complementary set of ratchet teeth (64) provided within the housing.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	GB	United Kingdom	MR	Mauritania
AU	Australia	GE	Georgia	MW	Malawi
BB	Barbados	GN	Guinea	NE	Niger
BE	Belgium	GR	Greece	NL	Netherlands
BF	Burkina Faso	HU	Hungary	NO	Norway
BG	Bulgaria	IE	Ireland	NZ	New Zealand
BJ	Benin	IT	Italy	PL	Poland
BR	Brazil	JP	Japan	PT	Portugal
BY	Belarus	KE	Kenya	RO	Romania
CA	Canada	KG	Kyrgyzstan	RU	Russian Federation
CF	Central African Republic	KP	Democratic People's Republic of Korea	SD	Sudan
CG	Congo	KR	Republic of Korea	SE	Sweden
CH	Switzerland	KZ	Kazakhstan	SI	Slovenia
CI	Côte d'Ivoire	LJ	Liechtenstein	SK	Slovakia
CM	Cameroon	LK	Sri Lanka	SN	Senegal
CN	China	LU	Luxembourg	TD	Chad
CS	Czechoslovakia	LV	Latvia	TG	Togo
CZ	Czech Republic	MC	Monaco	TJ	Tajikistan
DE	Germany	MD	Republic of Moldova	TT	Trinidad and Tobago
DK	Denmark	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	US	United States of America
FI	Finland	MN	Mongolia	UZ	Uzbekistan
FR	France			VN	Viet Nam
GA	Gabon				

TAMPER-PROOF CARGO SEAL**BACKGROUND OF THE INVENTION****1. Field of the Invention**

The field of the invention relates to tamper-resistant seals for securing cargo container doors, overseas shipping containers and the like.

2. Brief Description of the Related Art

It is often important to ensure that cargo shipped in trucks or containers has not been tampered with prior to arrival at its intended destination. In addition to locking the contents within the trucks or containers, tamper-resistant seals may be employed. Such seals should be locked permanently, and exhibit visible damage if opened at any point in time.

Various seals have been designed for securing containers and other equipment. U.S. Patent Nos. 3,146,012, 3,372,952 and 4,674,778 disclose examples of such seals.

Other seals have been specifically designed for securing bags. Such seals generally allow the strap portions of the seal to be pulled entirely through the locking portions thereof in order to cinch the bag opening. Cargo seals do not require this feature, and the strap can and generally does terminate at the locking mechanism. Two types of bag seals are disclosed in U.S. Patent No. 4,676,535 and commonly assigned U.S. Patent No. 5,123,686, respectively.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a tamper-proof seal for containers of various types.

It is another object of the invention to provide a seal which will readily exhibit evidence of tampering upon attempts to open the seal.

A still further object of the invention is to provide a seal which can be easily locked by the user, but which is substantially impossible to unlock without damaging the seal.

A tamper-proof seal is provided which accomplishes the above-listed objects of the invention, and which provides additional advantages as discussed in the detailed description which follows. The seal includes a housing having a strap engagement assembly. An elongate strap is coupled to the housing, and includes a free end which is insertable within the housing. A locking device is mounted to the free end of the strap, and is engageable with the strap engagement assembly. The locking device extends above the upper surface of the free end of the strap, and is deflectable towards the upper surface upon insertion within the housing.

The free end of the strap preferably includes a pair of locking devices, each of which extends parallel to the longitudinal axis of the strap. A projection preferably extends from the bottom surface of the free end of the strap. This projection blocks the opening to the housing, and increases the difficulty of opening the seal without leaving evidence of tampering.

The bottom surface of the free end of the strap also preferably includes a plurality of teeth. A teeth

engagement member is provided within the housing, and helps prevent withdrawal of the free end of the strap from the housing.

BRIEF DESCRIPTION OF THE DRAWINGS

5 Fig. 1 is a top perspective view of a seal according to the invention as applied to a closure;

Fig. 2 is a top perspective view of the seal assembly prior to deployment;

10 Fig. 3 is a sectional view taken along line 3-3 of Fig. 2;

Fig. 4 is a sectional view taken along line 4-4 of Fig. 2;

Fig. 5 is a sectional view taken along line 5-5 of Fig. 2;

15 Fig. 6 is a partially exploded, top perspective view thereof;

Fig. 7 is a sectional view taken along line 7-7 of Fig. 6;

20 Fig. 8 is a sectional view of a housing of the seal with the free end of a strap inserted therein;

Fig. 9 is a top plan view of the seal;

Fig. 10 is a bottom plan view thereof;

Fig. 11 is an end view of a strap teeth engagement assembly;

Fig. 12 is a side elevation view thereof; and

Fig. 13 is a top plan view thereof.

DETAILED DESCRIPTION OF THE INVENTION

A tamper-proof seal 10 is provided for sealing containers of various types, such as cargo containers and other containers or storage vessels where evidence of tampering by unauthorized persons is desired. Fig. 1 shows the seal 10 in one such application where it extends through the aligned openings of a pair of tabs 12 mounted to the doors 14 of a container. The seal 10 is constructed such that it is simple to apply to a container, and will provide obvious evidence that it has been opened or tampered with.

As shown in Figs. 2 and 3, the seal 10 according to the preferred embodiment of the invention includes a housing 16, an elongate strap 18 extending from one wall of the housing, and a tab 20 extending from another wall of the housing. The tab 20 is an optional feature. The strap and housing may be integrally formed from a semi-rigid polymeric material such as polypropylene having a Rockwell hardness of at least about R100.

A strap tooth engagement assembly 22 is positioned within the housing, and permanently secured thereto. This assembly is substantially identical to that disclosed in U.S. Patent No. 5,123,686, the disclosure of which is incorporated by reference herein.

The strap 18 has a generally flat configuration and terminates in a free end 24 which is insertable within the housing 16. The upper surface of the strap includes a plurality of parallel ridges 26 adjacent the free end 24 to facilitate handling. (Terms such as "upper" and "lower" are relative terms, and are used simply to define the

relative positions of various features of the invention).

The free end of the strap includes first and second locking devices 28. Each locking device includes a body portion including first and second end portions 28A, 28C connected to the substantially flat body of the free end of the strap. A central portion 28B connects the end portions 28A, 28C, as shown in Fig. 3. The free end of the strap includes a pair of parallel, elongate slots 30. Each slot is located beneath one of the central portions 28B of a locking device. These central portions 28B are accordingly deflectable towards the upper surface of the strap when pressure is exerted thereon. The free end 24 of the strap is relatively wide near the slots to compensate for the reduction in the strength of the strap due to the presence 15 of the slots.

The central portion 28B of each locking device includes a locking member 32 having a generally saw-toothed configuration. The front or insertion end of the locking member is inclined with respect to the upper surface of the strap, while the rear end extends substantially perpendicularly thereto. Each locking member extends above the plane of the upper surface of the strap. The elongate body portions of each locking device 28 run substantially parallel to the longitudinal axis of the strap when the 25 strap is in the position shown in Figs. 2-3.

The bottom surface of the free end of the strap includes a plurality of ratchet teeth 34. The bottom edges of the teeth are coplanar with the flat portions of the bottom surface. A lateral projection 36 including an inclined front surface 36A also extends downwardly from the bottom surface. This projection equals the maximum width of the free end of the strap, and includes a flat rear surface 36B extending perpendicularly to the strap bottom surface.

The housing 16 is integral with the strap, and includes a generally cubic main housing portion and a strap entrance chute 74. Referring to Fig. 9, the main housing portion includes four adjoining side walls 38 and an end wall 40. A pair of L-shaped members 42 and one of the side walls define a channel 44. Three elongate projections 46, 48, 50 extend from the side wall opposing the L-shaped members 42. A pair of opposing walls 52 extend from the L-shaped members 42. Each of these opposing walls 52 include an inclined surface 52A.

Referring now to Fig. 5, a lateral wall 54 having an inclined surface connects the opposing walls 52 near the end wall 40 of the housing. A portion of the end wall 40 adjoining one of the side walls defines a pair of shoulders 56 positioned between the respective elongate projections 46, 48, 50.

The strap tooth engagement assembly 22 is preferably integrally molded. Referring to Figs. 7-8 and 11-13, this member includes a first wall 58 which mates with the open side of the housing 16. The wall 58 is solid in construction.

A second wall 62 extends substantially perpendicularly from the first wall 58 of the tooth engagement assembly 22, forming a substantially L-shaped configuration. A teeth locking member 64 is secured to the second wall 62 by a pair of resilient, deformable legs 66. It includes a wedge-shaped end 68 extending beyond the resilient leg 66 farthest from the first wall 58. A pair of laterally extending wedges 70 are integral with opposite sides of the teeth locking member 64. The inclined surfaces defined by the wedges 70 are substantially coplanar, and are generally parallel to the inclined end surface of the wedge-shaped end 68. The locking member 64 includes ratchet teeth 72 designed for engaging the ratchet teeth 34 at the free end

24 of the strap 18.

The tooth engagement assembly 22 and housing 16 are dimensioned such that, when the former is inserted into the latter, the wedge-shaped end 68 of the teeth engagement member engages the inclined surface of the lateral wall 54. 5 The wedges 70 engage the inclined surfaces 52A of the opposing walls 52 of the housing. The engagement of these surfaces causes the locking member 64 to be urged away from the second wall 62 when a force is applied towards the end 10 wall 40 of the housing 16. Such a force is typically applied when one attempts to remove the free end of the strap from the housing.

A generally rectangular chute 74 is integral with the housing 16, and defines an opening through which the free 15 end 24 of the strap is inserted within the housing. As shown in Fig. 10, a pair of parallel channels 76 are defined within the upper wall of the chute. The channels function as a guide when the free end of the strap is inserted and the locking members 32 slide therethrough. 20 The exterior portion of the housing end wall 40 includes an upper surface which engages the inclined front surface 36A of the strap projection 36 when the free end 24 thereof is substantially fully inserted within the housing 16. The wedging action between these surfaces prevents the strap 25 from being pushed towards the wall 58 beyond the position shown in Fig. 8. A plurality of ribs 78 connecting the chute and housing add rigidity to the construction.

In use, the strap 18 is inserted through an opening in a closure, such as the opening defined by tabs 12 in Fig. 30 1. The free end 24 of the strap 18 is then inserted within the housing, where it is permanently locked. As the free end 24 of the strap is inserted, the locking devices 28 are deflected slightly towards the respective slots 30. Once the locking members move past the shoulders 56 within the

housing, they snap back to their rest positions as shown in Fig. 8. The ratchet teeth 34 of the strap engage the ratchet teeth 72 of the locking member 64. The legs 66 of the teeth engagement member 22 resiliently urge the locking member towards the strap.

Should one attempt to pull the free end 24 of the strap from the housing, the combination of the engaged ratchet teeth 34, 72 and abutment of the locking members 32 against the housing shoulders 56 provides such a strong 10 retentive force that the strap breaks before the free end 24 can be decoupled. This is accomplished without building a weakened portion into the strap, which is necessary in some prior art designs having less effective locking mechanisms. The resilient legs 66 cause the locking member 15 64 to move into even stronger engagement with the strap as they straighten from the positions shown in Fig. 8 as the strap is pulled in the direction opposite from the arrow. Clear evidence of tampering will accordingly be provided should a sufficient force be applied to the seal 10.

20 Although illustrative embodiments of the present invention have been described herein with reference to the accompanying drawings, it is to be understood that the invention is not limited to those precise embodiments, and that various other changes and modifications may be 25 effected therein by one skilled in the art without departing from the scope or spirit of the invention.

WHAT IS CLAIMED IS:

1. A tamper-proof seal for securing an enclosure, comprising:

a housing including a strap engagement assembly;

an elongate strap coupled to said housing, said

5 strap including a free end insertable within said housing and engageable with said strap engagement assembly;

said free end of said strap including a generally flat body having relatively wide upper and lower surfaces and relatively narrow edges connecting said upper and lower

10 surfaces;

a first locking device mounted to said free end of said strap, said locking device including a body portion having first and second end portions connected to said generally flat body, a central portion connected to and 15 suspended between said first and second end portions, and a locking member extending from said central portion and above said upper surface,

said central portion of said locking device being deflectable in a direction generally perpendicular to said 20 upper surface upon engagement of said locking member with said strap engagement assembly.

2. A seal as described in Claim 1, wherein said elongate strap has a longitudinal axis and said body portion of said first locking device is elongate and extends substantially parallel to said longitudinal axis.

3. A seal as described in Claim 2, wherein said locking member is integral with said central portion of said first locking device and has a generally saw-toothed configuration.

4. A seal as described in Claim 3, wherein said lower surface of said free end of said strap includes a plurality of teeth and said housing includes a teeth

engagement member which is engageable with said teeth upon insertion of said free end of said strap into said housing.

5. A seal as described in Claim 4 including means for resiliently urging said teeth engagement member into engagement with said teeth.

6. A seal as described in Claim 5, wherein said strap engagement assembly includes a shoulder integral with said housing which engages said locking member upon attempted withdrawal of said free end of said strap from 5 said housing.

7. A seal as described in Claim 2, wherein said free end of said strap includes a second locking device extending substantially parallel to said first locking device and having substantially the same construction as 5 said first locking device.

8. A seal as described in Claim 7, wherein said respective locking members are integral with said respective central portions of said locking devices and have generally saw-toothed configurations.

9. A seal as described in Claim 8, wherein said lower surface of said free end of said strap includes a plurality of teeth and said housing includes a teeth engagement member which is engageable with said teeth upon 5 insertion of said free end of said strap into said housing.

10. A seal as described in Claim 1, wherein said housing includes a generally rectangular opening for receiving said free end of said strap, said free end of said strap including an integral, lateral projection 5 extending downwardly from said lower surface and substantially between said edges, said strap and said lateral projection substantially closing said rectangular

opening upon insertion of said free end of said strap into said housing.

11. A seal as described in Claim 10, wherein said housing includes an abutment for engaging said lateral projection.

12. A tamper-proof seal comprising:

a housing including a strap engagement assembly; an elongate strap coupled to said housing, said strap including a free end insertable with said housing and engageable with said strap engagement assembly;

5 said free end of said strap including a generally flat body having relatively wide upper and lower surfaces and relatively narrow edges connecting said upper and lower surfaces; and

10 a first locking device movably coupled to said free end of said strap and extending above said upper surface thereof, said locking device being deflectable towards said upper surface upon engagement with said strap engagement assembly.

13. A seal as described in Claim 12, wherein said elongate strap has a longitudinal axis, said first locking device including an elongate body portion extending substantially parallel to said longitudinal axis.

14. A seal as described in Claim 13, wherein said free end of said elongate strap includes a second locking device extending substantially parallel to said first locking device and having substantially the same 5 construction as said first locking device.

15. A seal as described in Claim 14, wherein each of said locking devices includes a locking member extending upwardly from said elongate body portion, said locking members having generally saw-toothed configurations.

16. A seal as described in Claim 14, wherein said lower surface of said free end of said strap includes a plurality of teeth and said housing includes a teeth engagement member which is engageable with said teeth upon 5 insertion of said free end of said elongate strap into said housing.

17. A seal as described in Claim 16 including means for resiliently urging said teeth engagement member into engagement with said teeth.

18. A seal as described in Claim 12, wherein said housing includes a generally rectangular opening for receiving said free end of said elongate strap, said free end of said elongate strap including an integral, lateral 5 projection extending downwardly from said lower surface and substantially between said edges, said elongate strap and said lateral projection substantially closing said rectangular opening upon insertion of said free end of said elongate strap into said housing.

19. A seal as described in Claim 13, wherein said elongate body portion of said locking device includes a pair of end portions integral with said upper surface and a central portion suspended between said end portions, said 5 central portion including a locking member having an inclined front surface and a rear surface, said housing including a shoulder which adjoins said rear surface when said free end of said elongate strap is positioned within said housing.

20. A seal as described in Claim 13, wherein said free end of said elongate strap includes an elongate slot extending substantially parallel to said longitudinal axis, said elongate body portion of said first locking device 5 extending at least partially over said elongate slot.

21. A tamper-proof seal for securing an enclosure, comprising:

a housing;

5 a strap tooth engagement assembly positioned within said housing, said strap tooth engagement assembly including a locking member including a plurality of ratchet teeth and means for resiliently supporting said locking member;

an opening defined within a wall of said housing;

10 an abutment surface defined by said housing;

an elongate strap coupled to said housing, said elongate strap including a free end insertable within said housing through said opening and between said locking member and abutment surface;

15 a plurality of ratchet teeth defined by a lower surface of said free end of said elongate strap and engageable with said ratchet teeth of said locking member; and

20 a locking device extending from an upper surface of said free end of said strap, said locking device including a rear surface which opposes said abutment surface when said free end of said elongate strap is inserted within said housing.

22. A seal as described in Claim 21, wherein said locking device includes an inclined front surface.

23. A seal as described in Claim 21, including a projection extending from the lower surface of said free end of said elongate strap, said housing including an end wall engageable with said projection to limit the extent to

5 which said free end of said strap can be inserted within said housing.

1/6

FIG-1

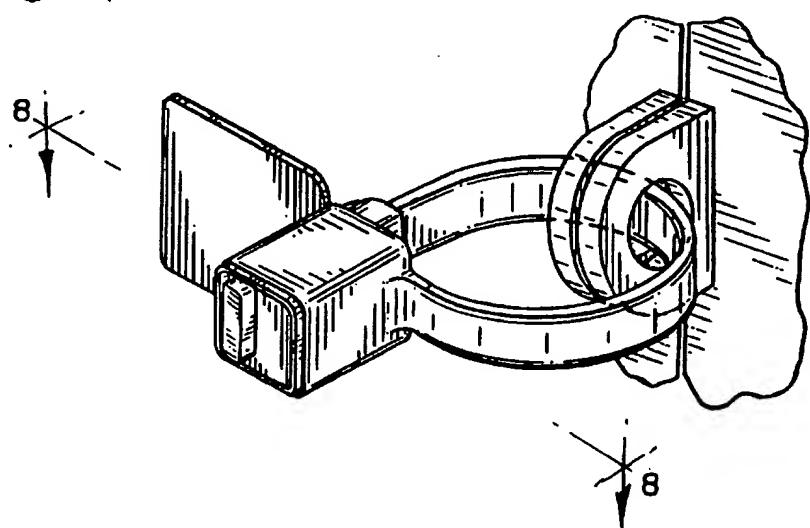
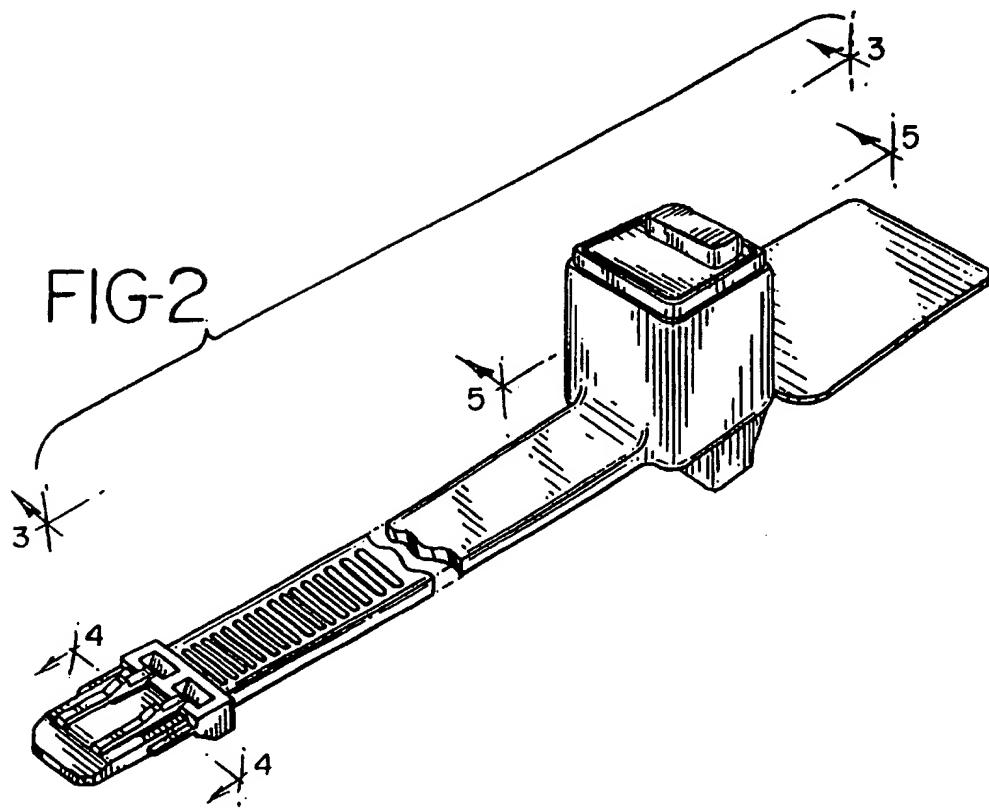


FIG-2



2/6

FIG-3

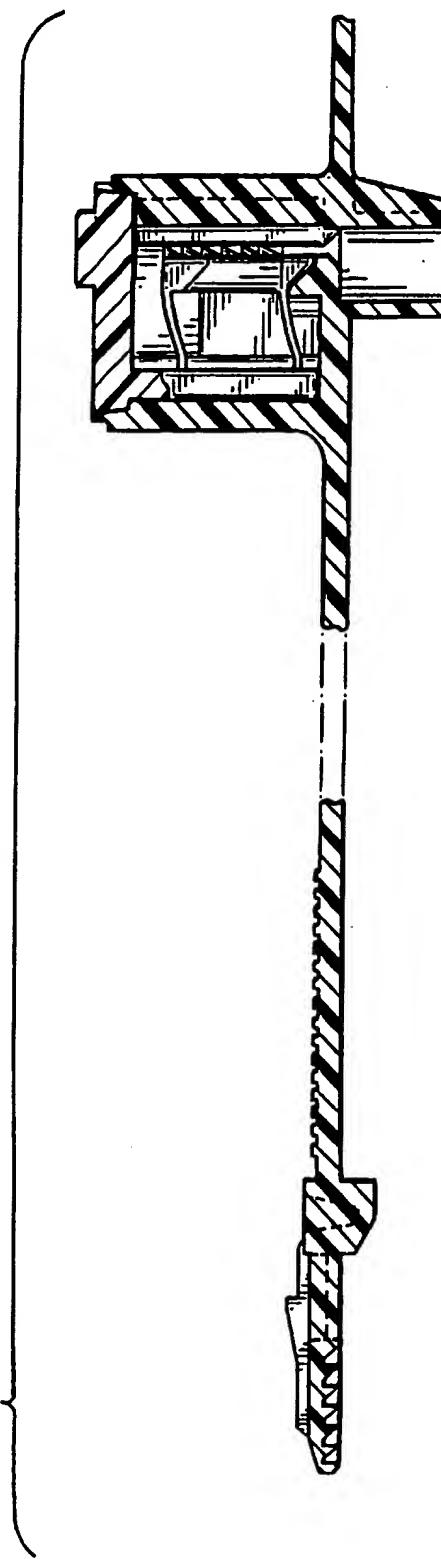


FIG-5

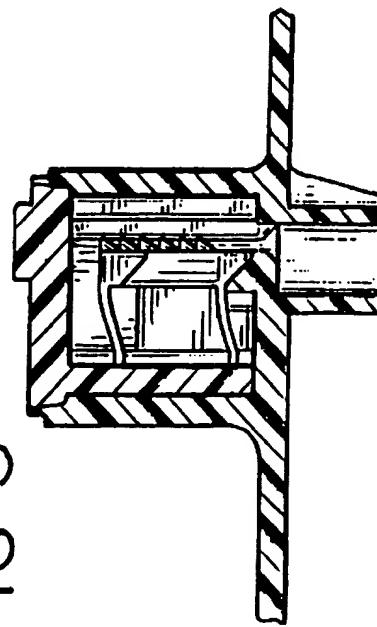
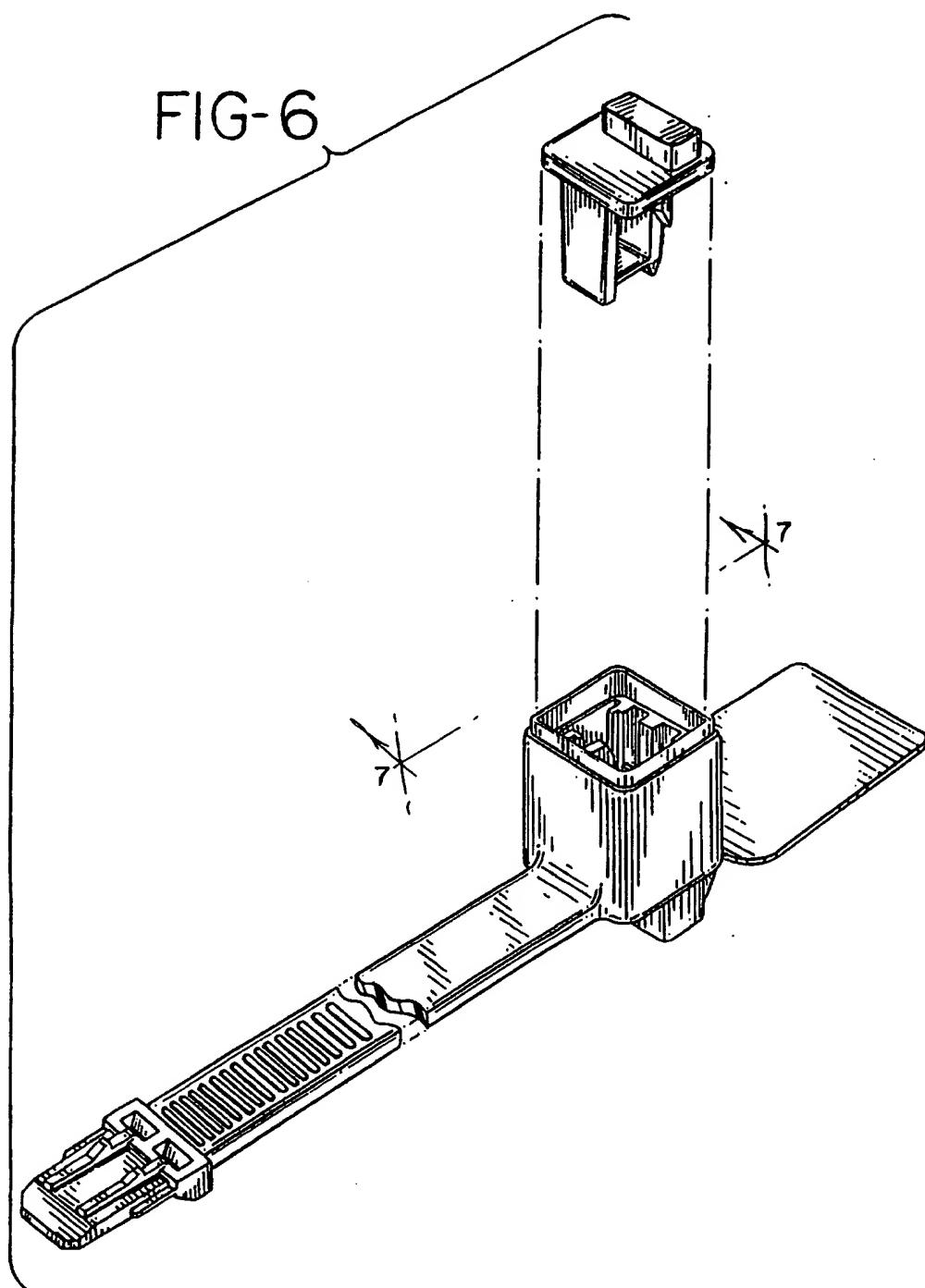


FIG-4



3/6



4/6

FIG-7

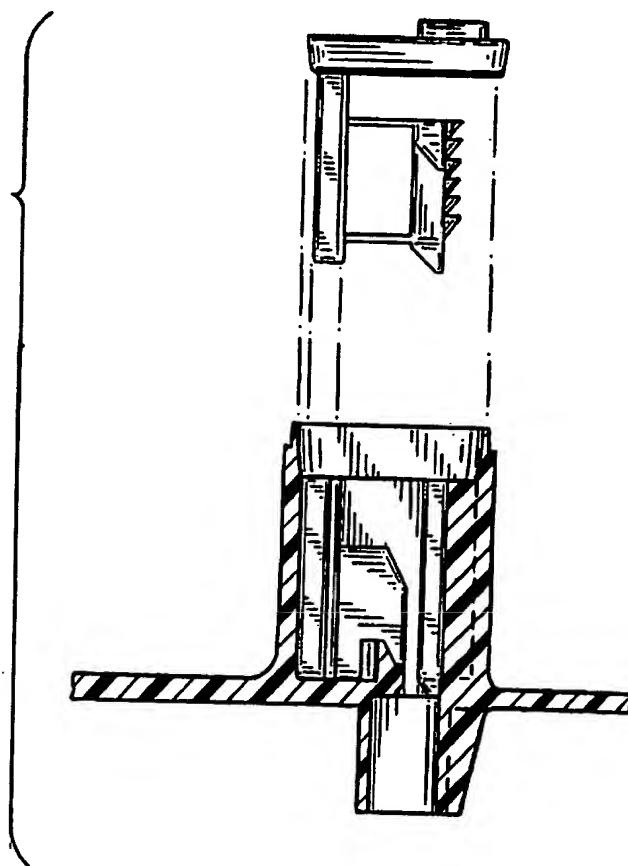


FIG-8

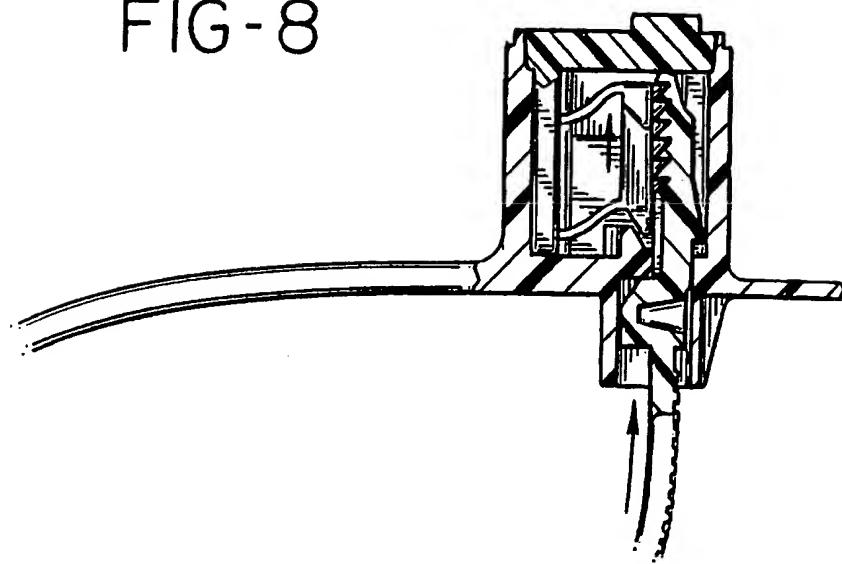


FIG - 9

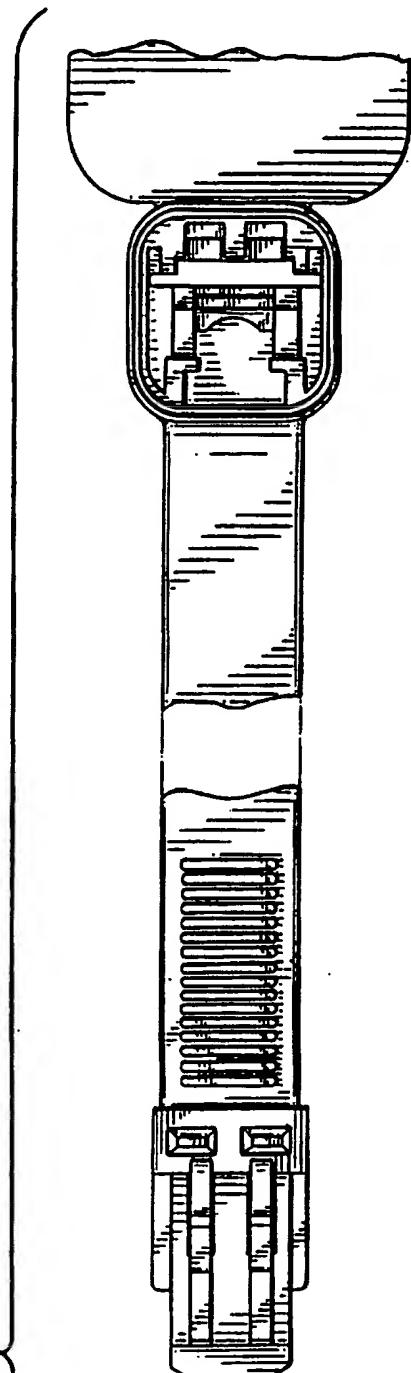
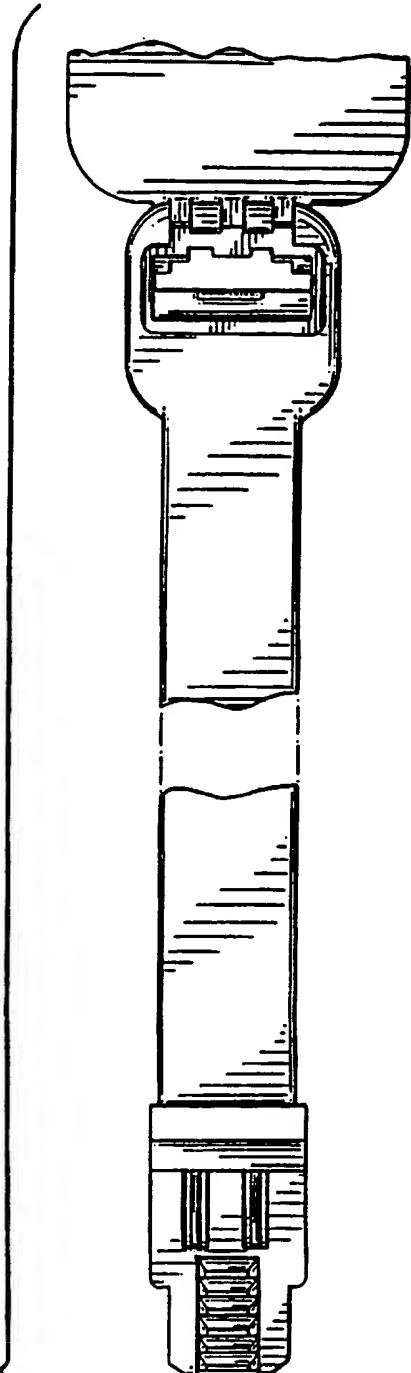


FIG - 10



6/6

FIG-11

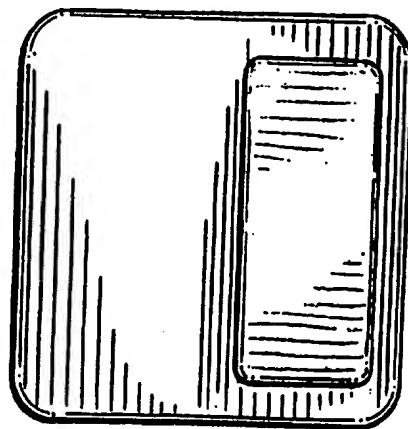


FIG-12

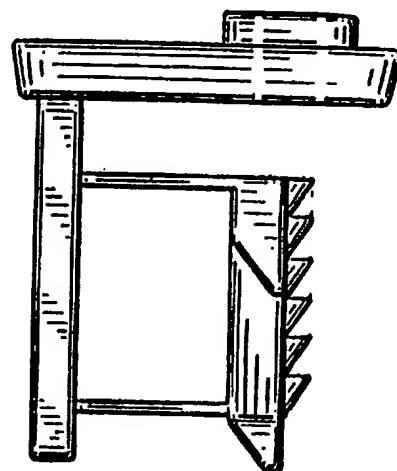
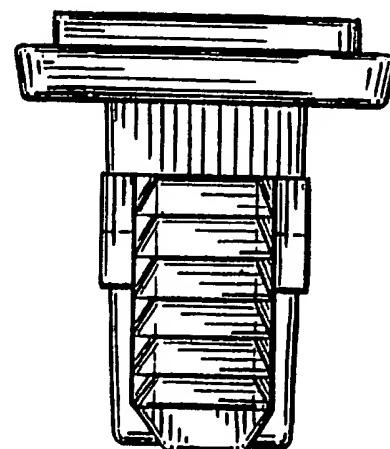


FIG-13



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/13117

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :B65D 33/34, 55/06
US CL : 292/307R

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 24/16PB, 17AP, 17B, 30.5, 616, 618; 292/307A, 307R, 317, 318, 319, 325, 331

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB,A 2,163,707A (MCCORMICK) 05 March 1986, Figures 1-3.	1-3, 10-13, 18-20
---		-----
Y		4-9, 14-17, 21-23
Y	US, A, 925,416 (BATTENBERG) 15 June 1909, Figure 7.	7, 8, 14, 15
Y	US, A, 4,532,679 (SCOTT) 06 August 1985, Figure 6.	4-6, 9, 16, 17, 21-23
X	US, A, 4,676,535 (MAUTNER) 30 June 1987, Figures 8-10.	1, 2, 12, 13, 18, 19, 20, 21, 22

 Further documents are listed in the continuation of Box C. See patent family annex.

• Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
E earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"A"	document member of the same patent family
O document referring to an oral disclosure, use, exhibition or other means		
P document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

18 DECEMBER 1995

Date of mailing of the international search report

31 JAN 1996

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No. (703) 305-3597

Authorized officer *My Niles*

GARY E. TREMSKY

Telephone No. (703) 308-0494

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US95/13117

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 4,854,014 (UENO) 08 August 1989, Figures 5 and 6.	1-3, 7, 8, 12-15, 19, 20
A	US, A, 5,123,686 (WENK) 23 June 1992, Figure 3.	1-23